REMARKS

This is in response to the Office Action dated February 16, 2005, in which the Abstract was objected, Claims 1, 9, 12 and 13 were rejected under 35 U.S.C. 103(a), and Claims 2-8, 10 and 14-21 were allowable if rewritten into independent forms. The Abstract has been amended as above to overcome the objection. It is respectfully submitted that all the pending claims are allowable.

Claims Rejections – 35 U.S.C. 103(a)

Claims 1, 9, 12 and 13 were rejected under 35 U.S.C. 103(a) as being unpatentable over O'Brien (US Patent 4,654,794), and further in view of Lehmann (US Patent 6,358,047).

With regard to Claim 1, the Examiner contended that:

"*O'Brien discloses recording an image using a solid-state light detector array (reads on diode array which detect light), so as to obtain a gray level value (note color data comprising gray level values) at each pixel of the solid-state light detector array (see col. 1, lines 53-60); calculating, i.e. measuring, an average gray level value of the image recorded by the solid-state detector array (see col. 3, lines 48-51); multiplying the average gray level value with a stray light factor to obtain a correction value (see col. 3, lines 52-59); and subtracting the correction value from the gray level of each pixel (see col. 6, lines 35-39).*"

The rationale proposed by the Examiner is respectfully traversed for the following reasons:

1) the monochromator, including spectrophotometer 4 and the diode array 6, is inoperative to record an image:

As disclosed by O'Brien, the diode array is a part of a monochromator (col. 2, lines 55-56). As is well known in the art, a monochromator typically includes an entrance slit that allows only a small area of the light beam to propagate into the monochromator, and the output of the monochromator is typically a spectrum showing the brightness or intensities of various color components of a light beam. Therefore, the diode array 6 arranged at the output of the spectrophotometer is inoperative to detect, or record the image of the tooth. Instead, all that the diode array 6 detects is the spectrum, that is, intensities at various wavelengths, of the light beam.

Without providing any device or structure operative to record an image of the tooth, O'Brien does not only fail to teach the step of "recording an image", but also fails show any desirability of performing such step.

2) disclosure of a diode array does not explicitly or inherently teach a solid-state light detector array:

A solid-state light detector array comprises an array of picture elements, namely, pixels, each functioning as a photosite for sensing incoming light and generating an electron when a photon is impinging thereon. The electrons emitted within the solid-state detector array are fenced within nonconductive boundaries, so that they remain at the areas where the photons strike. As long as light is allowed to impinge on a photosite, electrons will accumulate in that pixel. When the source of light is extinguished, simple electronic circuitry can be used to unload the solid-state detector array, count the accumulated electrons in each pixel, and process the resulting data into an image on an output media.

The diode array 6 as disclosed in O'Brien is simply an array of diodes that convert a light into an electrical signal. Further, as the light beam reflected from the tooth is propagating through the monochromator prior to incident on the diode array, only a single-wavelength light beam or a light beam within a specific band will be output from the exit slit of the monochromator at a time. As a result, what is recorded by the diode array is simply a spectrum of a light beam reflected from the tooth. The structure provided by O'Brien is inoperative to provide an image, there shows no desirability for using a solid-state light detector array as the diode array. Therefore, O'Brien not only fails to teach using a solid-state light detector array, but also fails to suggest that a solid-state light detector array can be used as the diode array.

3) color data does not inherently comprise gray level values:

As it is well known in the art, "color" of a light beam or an image is a wavelength-dependent characteristic. As defined in "Dictionary of Scientific And Technical Terms" by McGraw-Hill, color is a general term that refers to the wavelength composition of light, with particular reference to its visual appearance". Neither the general concept nor the dictionary definition suggests any correlation between "color data" and "gray levels".

"Gray level values", which is also known in the art as "gray scale", is defined as "A series of **achromatic** tones having varying proportions of white and black, to give a full range of grays between white and black" according to "Dictionary of Scientific And Technical Terms".

As the gray level values is basically an **achromatic** optical feature, it appears that the rationale of "the color data comprises gray level values" proposed by the Examiner is contra to the basic principles of optical physics.

In addition, as discussed above, all that can be output from the monochromator is a spectrum of a light beam reflected from the tooth, the Applicant does not understand how average gray level of such spectrum can be calculated as contended by the Examiner.

In the paragraph quoted by the Examiner, that is, col. 3, lines 48-51, O'Brien teaches:

"*Block 50 indicates the step of averaging the reading of several measurements in order to reduce signal to noise ratios and hence reduce overall reading errors*".

It appears that the Examiner has simply excerpted some teaching containing the term "averaging" to read on the step of "calculating an average gray scale value" without considering what is to be averaged in such teaching.

4) the Examiner fails to consider the references as a whole:

In addition to the above, the Examiner further quoted the teachings in col. 3, lines 52-59 and col. 6, lines 35-39 as the teachings of the steps "multiplying the average gray level value with a stray light factor to obtain a correction value" and "subtracting the correction value from the gray level of each pixel", respectively.

In col. 3, lines 52-59, O'Brien discloses "*The next step, indicated by block 60, is to operate upon the color data, previously normalized, recorded from the measurement of the patient's tooth, by multiplying such data with the stored power distribution curve of a given standard illuminant such as illuminant 'C'*".

Apparently, such teaching does not provide any suggestion of multiplying the average gray level with a stray light factor to obtain a correction value. Again, it appears that the Examiner has simply excerpted some languages containing a multiplication process upon two parameters totally uncorrelated to average gray level and stray light factor to read on the step of "multiplying the average gray level with a stray light factor" without explaining, in what stand, such multiplication process can result in a correction value desired in the next step as claimed in

Claim 1. By ignoring the resulting effect of "to obtain a correction value", the Examiner then excerpt the teaching "*The resulting data is subtracted from the data derived from illuminating tooth without a black backing, and the result is a value which is proportional to the degree of translucency of the tooth*" (col. 6, lines 35-39) to read on "subtracting the correction value from the gray level of each pixel" as claimed. O'Brien teaches subtract the data obtained by using a black backing 5 from the data obtained without using the black backing to obtain transparency factor of the tooth. Both the data derived from the setup with and without the black backing are totally uncorrelated with the color data and the power distribution from which the correction value should be obtained.

When applying 35 U.S.C. 103(a), the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination. *Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986). It appears that the Examiner fails to meet with the requirement of "considering the references as a whole" for rejecting Claims under 35 U.S.C. 103(a).

The Examiner further asserted that:

"*When O'Brien discloses processing color data of light reflected from an object, O'Brien does not explicitly call for process stray light data to enhance the image information. However, at the same field of endeavor, Lehmann discloses this feature (see col. 3, lines 34-40). At the time of invention was made, it would have been obvious to an ordinary skill in the art to incorporate the teaching of Lehmann's stray light enhancement process into O'Brien's system. The motivation of doing so is to provide an image enhancement process by correcting the stray light information.*"

Firstly, regardless what was disclosed in Lehnann, as discussed above, it appears that the system disclosed by O'Brien does not allow one of ordinary skill in the art to capture an image of an object; instead, only the spectrum of a light beam reflected from the object (tooth) can be obtained from O'Brien's system. As understood, the stray light is normally insignificant to an image when the brightness of the image is uniform. On the contrary, when the background of a specific region is significantly brighter than this region, the stray light may cause this region to look brighter than it actually is. In other words, stray light normally occurs to an image which contains regions with high brightness contrast. One may thus easily observe the stray light effect

on an image, but can hardly observe the stray light effect from simply a light beam which does not distinctively reflect brightness from various areas of an object. Therefore, there is no desirability for one of ordinary skill in the art to modify O'Brien by incorporating any stray light correction teaching, and a reasonable expectation of success for such modification does not exist.

Secondly, Lehmann discloses a tooth shade analyzer system and methods that use a sample box (or isolation sleeve) for isolating the tooth from the stray light (col. 4, lines 18-20). That is, instead of performing the steps of obtaining the gray level value, calculating the average gray level value, multiplying the average gray level with a stray light factor to obtain a correction value, and subtracting the correction value from the gray level as claimed in Claim 1, Lehmann uses a physical structure to block stray light from the ambient. This, although blocking the ambient stray light, cannot illuminate the stray light caused by the filters, lenses and other optical elements used within the imaging light and color measurement system.

As O'Brien and Lehmann, individually or in combination, fails to teach every element as claimed, the rejection over Claim 1 and its dependent Claims 9 and 12 is respectfully traversed.

With regard to Claim 12, the Examiner asserted:

"*Claim 12 is similarly analyzed as claim 1. As to the additional limitation of activating a software (note that the computer system comprises software 12), in which a plurality of correction values for various combinations of solid-state light detector arrays/lens/optical elements used for color measurement are stored (see col. 2, lines 65-col. 3, line 15).*"

In addition the features as claimed in Claim 1, Claim 12 further include the steps of:

"activating a plurality of correction values for various combinations of solid-state light detector arrays/lens/optical elements used for color measurement are stored;

entering a specific combination of a solid-state light detector array/lens/optical elements used for color measurement; and

recording an image using the specific combination of a solid-state light detector array/lens/optical elements used for color measurement entered to the software, to obtain a recorded image with a gray level value at each pixel of the solid-state light detector array;

wherein the software automatically subtracts each gray level value with a correction value corresponding to the specific combination of a solid-state light detector array/lens/optical elements used for color measurement.

O'Brien, in col. 2, line 65 to col. 3, line 15, teaches:

"*Digital computer 12 carries a number of the functions of the method of the invention to be described below, and controls the operations of printer 13 and a CRT screen monitor 14 and, optionally, a modem 16 for communicating with more distant points. Keyboard 17 is also coupled to computer to call up various menus and otherwise input data thereto. The computer functions to normalize the dental color data obtained by measuring reflected light off of the tooth by applying a correction factor to compensate for any parameter changes such as in the color signature of the light source. The computer operates on the resulting color data with the stored power distribution of a given standard illuminant, through multiplication, converts the modified color data to three tristimulus values of groups of dental shades, and identifies the matched shades to produce a printout of information by printer 13 indicative of the recipe to be employed.*"

In the above teaching, a correction factor is applied to the reflected light off of the tooth to compensate for any parameter changes, while the color data is operated with a power distribution of a given standard illuminant through multiplication, so as to convert the modified color data into three tristimulus values of groups of dental shapes. O'Brien does not teach how to apply the correction factor, and it appears that the power distribution used in the multiplication process is uncorrelated to the correlation factor. As discussed above, O'Brien basically fails to teach recording an image. With regard to Claim 12, O'Brien further fails to teach recording an image using a specific combination of a solid-state light detector array/lens/optical elements. Instead, O'Brien uses a diode array 6 at an output of a monochromator (spectrophotometer 4) for recording the output of the monochromator, which is typically a spectrum of a narrow area of the light beam reflected from the tooth. Further, O'Brien does not teach the step of "subtracting each gray level value with a correction value corresponding to the specific combination of a solid-state light detector array/lens/optical elements.

With regard to Claim 13, O'Brien fails to teach the step of multiplying an average gray level value of the gray level value at each pixel with a stray light factor.

A reconsideration and allowance is therefore respectfully requested.

If any additional fee is required, please charge Deposit Account Number 19-4330.

Respectfully submitted,

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Customer No.: 007663

By: ______________________

Kit M. Stetina
Registration No. 29,445
STETINA BRUNDA GARRED & BRUCKER
75 Enterprise, Suite 250
Aliso Viejo, California 92656
Telephone: (949) 855-1246
Fax: (949) 855-6371

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